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Small-Scale Business Survival and Inheritance: Evidence from Germany

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Abstract

In this paper we investigate whether small-scale businesses face financial constraints that affect their survival. We develop a model of moral hazard in which financial constraints arise endogenously. The model predicts that higher private assets relax financial constraints and have a positive effect on the firm's probability of survival. We test this proposition using German Socio-Economic Panel (GSOEP) data, which cover the period 1984–2004. The release from financial constraints is measured by inheritance. The empirical analysis confirms that the entrepreneur has a higher propensity to stay in business when she inherits capital. This effect is particularly strong for entrepreneurs that switch from self-employment into wage employment. These results are consistent with hypothesis that financial frictions have a perceptible impact on bankruptcy among small business firms.

Keywords: Entrepreneurship, survival, financial constraints.

JEL: G30, J20, L10

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1 Introduction

In a seminal paper, Fazzari, Hubbard and Petersen (1988) argue that the significant positive correlation between companies' investment decisions and cash flow in the US is a sign of imperfections in capital markets. As financial constraints prevent firms from reaching their optimal capitalization, investment policies are largely determined by the amount of internally-created funds. Although investment sensitivity to cash flows has received considerable attention, there is much less work on the link between financial constraints and a firm's business activity.[1] The departure from the optimal investment path influences not only the correlation between cash flow and investment expenditure, but it also affects the firm's survival. The aim of this paper is to examine the hypothesis that financial constraints determine the duration of the firm's lifetime.

The majority of the vast literature on the relationship between financial constraints and investment employs balance-sheet data of fairly large and listed firms. At the same time a relatively scarce research has been done for small-scale non-listed enterprises, which are considered as one of the most important contributors to more employment and growth (Holtz-Eakin and Rosen, 2005).[2] The main scope of this paper is to investigate the effects of financial constraints on small-scale companies survival. Our study is based on socio-economic data of German entrepreneurs. These data are more appropriate for investigating small-scale entrepreneurial firms than pure balance sheet data, because these firms are rarely managed by executive employees. Furthermore, their performance is highly dependent on the entrepreneur's personality and socio-economic environment.

In a world with symmetric information and complete contracting would neither agency conflicts nor control problems exist. Financial constraints are absent not only at the start of the business but also during the its lifetime. However, in reality asymmetric information prevails, contracts are incomplete and moral hazard occurs (Cressy, 2002).[3] Borrowing constraints arise to the extent to which intermediaries are not able to identify the entrepreneur's risk and her propensity to cheat. While investment of the entrepreneur's own capital reduces the cheating incentive (Aghion and Bolton, 1996), pledging collateral ensures the intermediary against a total loss of its claim at a later date (Besanko and Thakor, 1987). Thus, in the presence of borrowing constraints, the entrepreneur's wealth is likely to correlate positively with start-up decision. The empirical link between wealth and business foundation has been studied extensively. Most authors confirm a positive correlation (e.g. Evans and Jovanovic (1989) and Evans and Leighton (1989) on the US and Black, de Meza and Jeffreys (1996) on Britain).

The question of whether financial constraints continue in the years after the start-up of the business has received much less attention. The findings so far are controversial. Holtz-Eakin, Joulfaian and Rosen (1994) report a positive correlation in their study on the US, while Cressy (1996*b*) suggests that personal assets at start-up do not have significant effect on survival of British start-ups after controlling for individual characteristics. To the best of our knowledge, none of these studies investigate the effect of exogenous increase in wealth on start-up survival in a bank-based economy, such as Germany. The absence of this literature is especially striking since "... venture capital and mezzanine finance, essentially debt with equity-like features are still rare in Germany."[4].

In our study we develop a model of moral hazard and credit constraints closely related to Manove, Padilla and Pagano (2001). The model yields the hypothesis that availability of private assets increases the entrepreneur's probability to survive. We test this proposal by using the GSOEP data set. In order to make the wealth variation variable exogenous to the entrepreneur's decision we use inheritance as the proxy for an increase in private assets.[5] This empirical strategy follows Holtz-Eakin et al. (1994) who test for the importance of credit constraints by examining a sample of US individuals containing personal data of 1985 and 1987 and inheritance data of 1982 and 1983. They find that entrepreneurs who receive inheritances are more likely to remain in business and their revenues are substantially higher.

We find that exogenous wealth variations influence the survival of businesses.[6] In particular inheritance exerts a significantly positive effect on the survival probability of small-scale businesses, indicating that the reception of the inheritance allows entrepreneurs to overcome the problem of under-capitalization. Interestingly, there is distinct impact of inheritance on different transition paths. Entrepreneurs that switch from self-employment into employment experience an enhancement in their survival probability. However, inheritance fails to have a significant impact on the survival of their counterparts' transition into unemployment.

The rest of this paper is organized as follows. In the next section we develop the theoretical background. Section 3 illustrates the econometric model and presents the estimation results; and finally, Section 4 outlines conclusions and proposes areas of further research.

2 The Model

There is a continuum of risk neutral entrepreneurs of type θ_i. Each entrepreneur chooses a project that lasts two periods and needs in every period an investment of size I. In any period, the project has two possible quality levels. The high quality project, h-project, pays $p_h(I, \theta_i)X > 0$, and the low quality project, l-project, pays $p_l(I, \theta_i)Y > 0$, where $p_h(I, \theta_i) > p_l(I, \theta_i)\ \forall\, I$. For the sake of simplicity, we assume that the return from l-project is fixed to $p_l(I, \bar{\theta})Y$. The outcome of the h-projects is a function of entrepreneurial abilities, $p_h(I, \theta_i)X$ with $\theta_i = \alpha\,\bar{\theta}$, where $\partial p_h/\partial\theta > 0$. The standard concave relationship between $p_{\ j\in\{l,h\}}$ and investment I is assumed, $\partial p_j/\partial I > 0$, $\partial^2 p_j/\partial I^2 < 0$. Furthermore, the project will fail with certainty if the entrepreneur invests nothing, $p_j(0) = 0$. At the end of each period all profits of the project are distributed as dividends and unsuccessful entrepreneurs leave the market. We assume that investment in project h is socially desirable:[7]

Assumption 1.

$$p_h/p_l > Y/X\ \forall\ I.$$

The entrepreneur who is endowed with project qualities such that $p_h(I, \theta_i)/p_l(I, \bar{\theta}) = Y/X$ is considered a benchmark case and denoted as type $\theta_i = \hat{\theta}$.

To finance his project, each entrepreneur borrows from one bank. Borrowing contracts last only one period. There is a continuum of perfectly competitive risk neutral banks which face a perfectly elastic supply of funds. For simplicity of analysis, the interest rate is normalized to zero. Banks know the values of all model parameters, but they cannot observe the entrepreneur's choice of quality level in the first period. Thus, at the beginning of a relationship, they cannot deter the entrepreneur from choosing a project quality that is unfavorable for the bank. However, given that there is a relationship in period 1 and that banks invest the cost S at the beginning of period 2, they can screen out the l-project in period two.

While the entrepreneur lacks liquid funds, she owns some amount A of private assets. If the outstanding debt is secured and bankruptcy occurs, the bank seizes the entrepreneur's private assets. The asset's liquidation causes transaction costs of $(1 - \beta) A$ with $\beta \in [1, 0)$.

Let $\langle IR, A \rangle$ represent a standard debt contract with initial investment I, repayment rate R and collateral A. The bank is protected from the consequences of a failed project only by pledged assets A. Thus, it offers the contract $\langle IR, A \rangle$ only if the expected return $B_j = p_j RI + (1 - p_j)\beta A - I \geq 0$.

Let E_j denote the entrepreneur's expected net profit of a project from a contract $\langle RI, A \rangle$. Then the expected profit is $E_h = p_h(X - RI) - (1 - p_h)A$ with choice h and $E_l = p_l(Y - RI) - (1 - p_l)A$ with choice l.

Our aim is to demonstrate that assets are crucial for survival. In doing so, we need to establish that in order to break even banks will deter entrepreneurs from their optimal investment by rationing with respect to project size. Consequently, we restrict our attention to values of θ for which a restriction of the loan size I occurs. We now proceed to show that there is a range of parameter values θ for which some entrepreneurs are financially constrained, yet constraints can be relaxed by pledging private assets. To do this, we first characterize the conditions of equilibrium. Then we describe the benchmark case of entrepreneurs who have no private assets: $A = 0$. In the third step, we derive the relationship between assets and financial constraints in period 1. Note that in the first period there is no screening option, as it can arise only from an already existing bank-client relationship. In the fourth step, we analyze the impact of the screening option on the relation between assets and survival. Proofs of propositions are given in the Appendix.

Period 1

In equilibrium the following conditions are satisfied:

C1: *Participation constraint of banks.* $B_j \geq 0$,

C2: *Profit maximization by the entrepreneur.* $\max_{I,A} E_j$,

C3: *Incentive compatibility constraint.*

$$E_h(IR_h, A) \geq E_l(IR_h, A) \text{ and} \tag{1}$$

$$E_h(\hat{I}R_h, A) \geq E_l(I_l^* R_l) \text{ or} \tag{2}$$

$$E_h(\hat{I}R_h, A) \leq E_l(I_l^* R_l) \tag{3}$$

C4: *No entry of banks.* $B_j = 0$,

where $\hat{I}$ denotes the investment volume that establishes indifference between h and l, and I_l^* is the optimal investment if banks only offer a contract, that enables them to break even with the l-project. We assume that the entrepreneur chooses h in case of indifference between the two qualities.

If the contract violates (1), but satisfies (2) in C3 the entrepreneur chooses quality l according to C2, and the bank experiences a loss. C1 implies that such a contract will never be offered in equilibrium. Also, no new banks enter the credit market in equilibrium. Thus, C1 and C4 are only compatible if $B_j = 0$ and $R = (I - (1 -$

$p_j)\beta A)/(p_j I)$. If the contract satisfies (1), but violates (2) the entrepreneur would prefer a contract which allows a bank to make a small profit on the low quality to a contract that satisfies (1). New banks could enter the market by offering such a contract. Therefore C1 and C4 are only compatible if the bank offers a single contract that allows it to break even with the l-project. According to C3, quality h is realized if, and only if,

$$\begin{aligned} p_h(X - \frac{I-(1-p_h)\beta A}{p_h I} I) - (1-p_h)A &\geq p_l(Y - \frac{I-(1-p_h)\beta A}{p_h I} I) - (1-p_l)A \\ A &\geq \underbrace{\frac{I(p_h - p_l) - p_h(p_h X - p_l Y))}{(p_h + \beta(1-p_h))(p_h - p_l)}} \\ A &\geq f(I, \bar{\theta}, \theta_i, X, Y) \\ \text{and } E_h(\hat{I}(A)R_h, A) &\geq E_l(I_l^* R_l). \end{aligned}$$

The entrepreneur achieves maximal profit E_h if he invests $I = I^*$ such that

$$\frac{\partial E_h}{\partial I} = \frac{\partial p_h(I^*, \theta_i)}{\partial I^*}\Big(X + (1-\beta)A\Big) - 1 = 0$$

is satisfied. Denote the θ_i satisfying $f(I^*, \bar{\theta}, \theta_i, X, Y) = 0$ as $\tilde{\theta}$. Then, we can state the following:

Proposition 1. Entrepreneurs of type $\theta_i \in (\hat{\theta}, \tilde{\theta})$ without private assets A are financially constrained in equilibrium, that is $I < I^*$.

Consider the benchmark type $\hat{\theta}$. Such entrepreneurs own project qualities l and h that yield the same expected gross return. However, due to l's higher probability of default, the bank's needed return rate to break even, R, is lower in the case of h for every amount of $I > 0$. For any $I > 0$, condition $C3$ part (1) is violated and an entrepreneur of type $\hat{\theta}$ would cheat. The entrepreneur would take the contract $\langle R_h I \rangle$, if offered, but realizes quality l. As the bank expects losses from such a contract for all positive loan sizes, it denies financing at all and financial constraints C are maximal, $C = I^* - 0 = I^*$. However, the bank can break even and offer some positive amount of credit if it offers only the contract $\langle R_l I_l^* \rangle$. The strategy of restricting itself to the break-even contract for the low quality $\langle R_l I_l^* \rangle$ eases C to $C = I^* - I_l^* > 0$. Entrepreneurs only realize quality l but achieve positive earnings.

The cheating incentive in case of the contract $\langle R_h I \rangle$ is only weakened if quality h becomes better, that is θ_i increases. A higher ability induces $E_h(\hat{I} R_h)$ to rise but $E_l(I_l^* R_l)$ stays constant. Thus, there exists a certain level $\breve{\theta}$ where both profits are equal. For all entrepreneurial abilities higher than $\breve{\theta}$, financial constraints relax monotonically, that is $C = I^* - \hat{I}$ shrinks and eventually approaches zero as θ_i approaches $\tilde{\theta}$. These financial constraints deter entrepreneurs of type $\theta_i \in (\hat{\theta}, \tilde{\theta})$ from achieving their optimal investment level, and reduce their probability of success.

Proposition 2. For any given type $\theta_i \in (\breve{\theta}, \tilde{\theta})$ the entrepreneur's probability of survival increases with pledged assets A. For any given type $\theta_i \in (\hat{\theta}, \breve{\theta})$ the probability of survival increases if the pledged assets A are large enough.

Private assets securing debt cause a dead weight loss of $(1-\beta)A$ for project variant h and $(1 - \frac{(1-p_h)p_l}{(1-p_l)p_h} \beta)A$ for variant l if liquidated. As banks only participate if they are able to break even, the entrepreneurs have to bear the additional cost. The cost arises with probability $1-p_j$. That is, the expected loss caused by pledging private assets are higher with quality l than with quality h. By securing debt, the entrepreneur renders quality l less attractive and lowers his motive for cheating. Consequently, banks are prepared to give higher loans if private assets can be pledged. For the higher ability range $\theta_i \in (\breve{\theta}, \tilde{\theta})$ financial constraints $C = I^* - \hat{I}(A)$ relax monotonically with A: $\partial C / \partial A < 0$. Due to the higher investment I, the entrepreneur's probability of default also decreases. This result is in line with theoretical predictions of Cressy (2006), who finds that undercapitalized firms have lower survival rates. However, in the low ability range $\theta_i \in (\hat{\theta}, \breve{\theta})$ a relaxation of financial constraints occurs only if A is large enough to push the crucial investment $\hat{I}(A)$ to such an amount that $E_h(R_h \hat{I}(A), A) > E_l(R_l I_l^*)$.

Period 2

In period 2 the successful entrepreneurs apply again for financing. Due to their continuing relationship, banks have acquired an additional option, which enables them to screen out the l-quality at a cost S. With a perfectly competitive loan market, banks would offer to screen projects as a service to entrepreneurs, who would then bear the cost of screening. Note that entrepreneurs who adopt a second period loan contract from a screening bank will never be prepared to pledge private assets. If a bank does not intend to screen their clients, it will serve them unscreened.

The participation constraint of the bank with screening is $I + S = p_h(\theta_i, I)R\,I$. In this case, financial constraints are not binding anymore, and the entrepreneur invests optimally. $I = I^*$ yields an expected profit of $E_h^S = p_h(\theta_i, I^*)X - I^* - S$. Thus, the equilibrium screening condition will be the following:

C5: *Screening.* $E_h^S(I^* R_h^S(I^*)) \geq E_h(IR_h, A) = E_l(IR_h, A)$.

Denote the cost level that satisfies $E_h^S(I^* R_h^S(I^*)) = E_h(IR_h, A) = E_l(IR_h, A)$ as $\bar{S}$. Then, C5 leads to

Proposition 3. If banks are sufficiently efficient in screening, $S \leq \bar{S}$, private assets will not be pledged. Therefore they do not determine the probability of a firm's success anymore. If banks possess a low screening efficiency, $S > \bar{S}$, assets continue to determine the firm's success probability.

Suppose that the entrepreneur owns a fixed amount of private assets $\bar{A}$. The selection of the screening option implies an additional cost of S with certainty, whereas the non-screening option forces the entrepreneur to bear both the expected dead weight loss resulting from the liquidation of assets and the cost of suboptimal investment, $I < I^*$. The screening option will be selected if S is below the sum of the two loss components. As these costs are fixed for a given level of assets, and $E_h^S(I^* R_h^S(I^*))$ continuously decreases with S there must exist an $S = \bar{S}(\bar{A})$ in which screening and non-screening options yield the same expected profits. The screening option is superior to the non-screening option for all S below this level, $S \leq \bar{S}(\bar{A})$. In this efficiency range, banks abandon the security. Consequently assets will no longer influence the firm's probability of success.

If the efficiency level is too low, $S > \bar{S}$, the screening option will be dropped and the probability of success remains dependent on pledgable assets.[8]

Empirical Implications. The most important empirical implication is the positive relationship between the availability of assets and the probability of survival. If moral hazard is present in the sense that entrepreneurs are constantly inclined to gamble for a higher profit at the expense of the external financier, availability of assets increases the probability of success. This phenomenon occurs not only at the start-up point but also in a later phase of the venture. The transmission channel is the relaxation of financial constraints induced by pledging private assets as collateral. Only if banks are highly efficient in screening can the positive relationship between assets and probability of success cease to exist once the enterprise has been successfully started. A low screening efficiency immediately implies that assets and the probability of survival remain positively related during the firm's lifetime. However, there is a distinction between the upper and the lower ability range, $\theta_i > \breve{\theta}$ and $\theta \in (\hat{\theta}, \breve{\theta})$ respectively. In the upper range a marginal increase of pledged assets affects the probability of success positively. In the lower range the amount of assets must be large enough to remove contraints and increase the chance of survival.

The model also predicts that ceteris paribus financial constraints would be eased if the distance between the two project qualities increases. A higher distance occurs if the entrepreneur's ability improves and/or the gross return of the h-project increases. The latter is to be expected if the entrepreneur operates in a branch with favorable market conditions such as a fairly low competition.

Of course there could be other mechanisms that link inheritance to firm survival. For example, individuals who inherit greater amounts of wealth (for example by inheriting ongoing businesses) also inherit networks and connections that are important for the development of the business. In this case inheritance would be a proxy for parents who had been self-employed, too.[9] The driver for survival would be the family tradition of self-employment rather than the relaxation of financial constraints. In the next section we account for this alternative explanation as well by investigating a specific sample which contains only entrepreneurs that have no self-employed parents.[10]

3 Empirical Strategy and Results

3.1 Data

To investigate the effects of a discrete increase of private assets on the likelihood to survive as an entrepreneur, we work with the German Socio–Economic Panel (GSOEP).[11] It is a wide-ranging representative longitudinal study of private households. It provides information on all household members, consisting of Germans living in the Old and the New German States, foreigners, and recent immigrants to Germany. The Panel started in 1984 and we use waves up to 2004. Our initial data set includes over 900,000 individual year-long observations. In 2004, there were more than 12,000 households, and nearly 24,000 persons were sampled. This survey contains an extensive set of demographic and household characteristics, including information about labor market status and income. Thus, it provides both detailed information on entrepreneurs and their socio-economic environment in addition to information on their firms such as size (in discrete ranges) and industry.

Empirical testing requires us to define both *inheritance* and *self–employment* as terms. As in Taylor (1999), we use data collected annually concerning labor market activity in the periods between interviews. An individual is defined as self-employed if she considers herself as: a Self-employed farmer, Free-lancer, Self-employed with exactly nine Coworkers or less, Self-employed with greater than nine Coworkers, or Help In the Family Business. Inheritance is defined using two types of questions. All waves after 2000 include inheritance indicators. To capture the occurrence of inheritance before 2001, we use information from the 2001 questionnaire. It has three questions related to each of the years of three last inheritances. Based on these sources of inheritance information, we generate the inheritance binary and continuous variables, *inheritance* and *amount*. We apply a number of selection criteria to the data. First, we include only self-employed individuals aged 21-65. Concerning the duration analysis, the duration variable is the spell of self-employment. In our data, we remove those spells for which we do not know their exact starting year (left-censoring). We drop all individuals with multiple spells in the basic sample. After screening we have 1,563 self-employment spells and 5,353 person-year observations.[12]

The other variables are constructed as follows. The dummy variable sex_{it} is equal to one, for females and zero otherwise. The individual's age during the first year of self-employment activity is represented by age_{i1} and age_{i1}^2. Size of the start-up is captured by $size_{2,i1}$ (equals to one if entrepreneur has less than five employees inclusive) and $size_{3,i1}$ (equals to one if entrepreneur has more than six employees inclusive) dummy variables. The omitted category is no employees. Individual income at the beginning of self-employment spell is $income_{i1}$. The type of the firm is represented by $manufacturing_{it}$ and $service_{it}$ dummy variables, which represent the manufacturing and services sectors, respectively, while the agricultural sector is used as a reference group. This grouping of entrepreneurs is based on the NACE code. Previous unemployment experience is represented by $unemployed_{i0}$, which is equal to one if a person switched from unemployment to self-employment and zero otherwise. The variable $married_{it}$ provides information about the current marital status. It is equal to one if the individual is married and lives together with the partner and zero otherwise. This variable characterizes whether there is a rather typical family background. Finally we employ three dummy variables which reflect the person's level of education or training (in years). High school education level is represented by $educ_{2,it}$, while $educ_{3,it}$ indicates (school) graduation and some type of apprenticeship and $educ_{4,it}$ is the indicator for university studies.

Means and variances for the annual means of all variables employed in the analysis are described in Table 1. The mean of lagged inheritance in our person-year data is merely two percent.

3.2 Econometric Model and Results

In this section we present our estimation results on the link between the hazard of abandoning self-employment and inheritance. Following Carrasco (1999) and Taylor (1999) the determinants of self-employment tenure are estimated using the proportional hazard model specification

$$\lambda(t|X) = \lambda_0(t)\exp(X'\beta)$$

where $\lambda(t)$ is the base-line hazard, t is duration to date in self-employment, X is the vector of explanatory variables and β is a vector of parameters which is unknown.[13] The selection of control variables regarding the entrepreneur's ability and business environment follows the work of Taylor (1999) and Carrasco (1999), subject to data availability constraints.

Table 2 presents the results from the discrete time hazards model (complementary log-log). A variable with a positive coefficient is associated with an increased hazard rate and a decreased survival time. Every model specification includes time variant and time invariant covariates. Variables with the index $t = 1$ are time invariant and correspond to values at the first year of the period. Lagged inheritance has the index $t - 1$, while unemployment experience is dated by $t = 0$. Note that respondents are often reluctant to report their true amount of wealth. The lower number of observations in column (3) and (4) reflects this reluctance.

In order to check robustness of our results with respect to baseline hazard specification, we treat the baseline hazard both semi-parametrically and non-parametrically. In columns (2) and (4), it is a log-baseline hazard model, which is analogous to Weibull model's shape parameter. In the other columns, non-parametric estimation is employed. As there are no events in some years, we re-group into four time periods for the sake of identification. The baseline hazard in columns (1) and (3) therefore consists of the following periods: (i) the first year, (ii) from two to five years inclusive, (iii) from six to ten years inclusive, and (iv) more than ten. Meyer (1990) suggests that non-parametric estimating of hazard line has advantages comparing to the semi-parametric one. The former approach provides more useful diagnostics and avoids inconsistent estimation of covariate coefficients when the baseline hazard is poorly specified.

All estimates are consistent with our theoretical predictions. Thus, lagged change in assets has a positive effect on a firm's survival. The sign of lagged inheritance variable is in line with Holtz-Eakin et al. (1994) who, using data on the US, show that receiving an inheritance increases the probability of business survival. Furthermore, similar to Cressy (1996*b*), age as a proxy for entrepreneurial ability is more important than income at the start of a company. The hazard is a U-shaped function of age, suggesting that individuals are more likely to quit self-employment activities at young and elderly ages (Cressy, 1996*a*). Previous unemployment experience, another proxy for ability, increases the exit rate from self-employment, which is in line with other findings. As in Taylor (1999), marriage and level of education have statistically insignificant effects on survival. Industry effects emerge with the lowest rate of survival in the services sector. In line with Van Praag (2003), start-ups in the agricultural sector have the highest survival rate. This result points at relatively unfavourable conditions for small-scale businesses in the service sector and fairly favourable conditions in the agricultural sector.

Allowing for unobserved heterogeneity does not change the conclusions about effects of inheritance.[14] The likelihood ratio test of zero unobserved heterogeneity is not rejected indicating that unobserved heterogeneity is not important. The coefficients by the lagged inheritance variable show the same strong effect as observed before.

Figure 1 depicts the predicted hazard and survival rate showings the evolution of a person's risk of failure over time. We observe that a married man aged 40, with a starting personal income of 5,000 EUR, and who is working in manufacturing sector is more likely to avoid business failure if he received an inheritance in the previous period.

In order to test the robustness of our qualitative results we have experimented with samples excluding self-employed farmers and family business helpers; and including persons with multiple spells. In Table 3 columns 1 and 2 report the results for a sample of German entrepreneurs which include only 3 categories: Free-lancers, Self-employed with exactly nine Coworkers or less, and Self-employed with greater than nine Coworkers. Columns 3 and 4 of Table 3 include also individuals with multiple spells. The qualitative findings remain the same as in the basic sample.

As pointed out before inheritance could be a proxy for having one's roots in a family of self-employed. We apply our estimation equation to a specific sample which comprises only entrepreneurs that have no self-employed parents to discriminate between the moral hazard hypothesis and the alternative explanation of having inherited networks and business expertise. The results are presented in Columns 5 and 6 of Table 3. The negative impact of inheritance on the hazard rate is significant. This finding supports our hypothesis that financial restrictions might be the main causal mechanism.

Finally, there is the possibility that self-employed individuals need similar skills then employed individuals to succeed. In this case the transition path would reveal distinct ability levels. The transition from self-employment to unemployment would reveal relatively low occupational skills whereas the transition to wage employment would signal relatively high skills. The model suggests that assets affecting survival is more likely in the higher ability group. We employ multinominal logit estimates of competing risk models to capture the differences in the survival probabilities between the two distinct groups. Table 4 report the results of the log-baseline hazard specifications.

The results for the wage employment hazard follow the pattern of single risk models. However, the downward effect of lagged inheritance is only present for entrepreneurs that transition into employment. It disappears for the unemployment hazard model. This outcome is compatible with the model provided that the transition path captures indeed distinct ability ranges. However, given that only a small fraction of the sample switches out of self-employment into unemployment (99 out of 986), we note the possibility that the result is only an artifact of data constraints. Interestingly the initial size of the venture matters for the transition from being an entrepreneur into unemployment but not for those founders that switch into employment.

4 Conclusions

In 2004 the number of insolvencies in the Western Europe added up to 156,245 in 2004. In 2005 almost 40,000 German firms declared bankruptcy.[15] Small-scale German enterprises are considered particularly fragile due to their assumed lack of investment. Under-capitalization pervades if firms face financial constraints not only at their start-up but also during their lifetime. In this paper we develop a model in which financial constraints occur endogenously due to persistent moral hazard. The model predicts that private assets may positively affect the firm's survival by relaxing financial constraints, not only when the business is started but also in a later phase. We test the hypothesis that the survival of small-scale businesses is determined by persistent financial constraints with GSOEP data. In doing so, we proxy the release of financial constraints by inheritance which has the advantage of not being subject to the entrepreneur's decision.

Provided that we have identified the main causal mechanism, our principal finding suggests that financial restrictions decrease the entrepreneur's survival chance by deterring her from the optimal investment path. The receiving of an inheritance significantly increases the survival probability of small-scale businesses. However, the sensitivity of hazard to inheritance is not significant for entrepreneurs that transition from self-employment into unemployment. Surprisingly, the survival probability of this category of entrepreneurs is higher if the initial firm size is larger.

If our results capture correctly the persistence of financial constraints then the finding could indicate that, in the case of small-scale enterprises, the German house-bank system is not as effective in dealing with asymmetric information and moral hazard as sometimes suggested in the literature. Moreover, the ongoing reliance of small-scale entrepreneurs on their own funds may signal that German venture capital firms are not yet prepared to deal with this type of firms. The evidence would then be in line with the perception that governmental intervention via specific programs meant to improve the capitalization of the German medium-sized businesses has a role in a policy towards fostering entrepreneurship in Germany. Of course, it is not to be expected that bureaucrats would do better than venture capitalists and housebanks in overcoming moral hazard and asymmetric information. But it should be considered whether public programs that back the financiers' dealing with the specific risk of small business finance such as refinancing credit lines for venture capitalists or public loans granted alongside with the bank loan could help to weaken inefficiencies stemming from imperfect capital markets.

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Notes

[1]Kaplan and Zingales (1997) argue on measurement of financial constraints.

[2]Aghion, Dewatripont and Rey (1999) stress the importance of entrepreneurial firms for innovation. Moreover, small scale enterprises are said to be crucial for channeling financial sector reforms into growth (King and Levine, 1993).

[3]See also Cressy and Olofsson (1997) and references therein for a comprehensive analysis of small business financing in Europe.

[4]Citation: The Economist, "The loan factory", April 16th, 2005

[5]Testing for the importance of financial constraints by using the stock variable wealth is subject to an endogeneity problem. See e.g. Xu (1998) and Hurst and Lusardi (2004).

[6]Hurst and Lusardi (2004) argue that inheritance cannot be considered as an exogenous increase of wealth. They suggest that the time of the windfall relative to the business entry decision is crucial, and that individuals receiving an inheritance are also more likely to start a business before receiving an inheritance. We also experiment with current and lead values of inheritance and receive marginally significant and insignificant relationships, respectively.

[7]Certain cash flows are never achieved: $p_j(I^*, \theta) < 1$.

[8]Note that additional pledgable assets increase the attractiveness of the non-screening option as the expected profit $\bar{E}_h(IR_h, A)$, generating indifference between the two project qualities, $E_h(IR_h, A) = E_l(IR_h, A)$, increases. A jump in available assets may thus increase $\bar{E}_h(IR_h, A)$ to such a level that the screening option is ruled out and banks invest a lower amount of I, $I < I_S^*$, due to their credit constraint $C = I^* - I(A)$. However, a negative jump in the probability of success will never occur if banks are not efficient enough in screening.

[9]We are grateful to the referee for raising that point.

[10] A second concern is that inheritance allows individuals to stay in business too long as the additional private funds may enable self-employed individuals to cover business expenditures despite loss-generating operations, or to cover unforeseen expenses which would otherwise threaten the firm's survival. However, given that individuals are behaving rationally they will employ their inheritance for improving the survival chances only if the expected net value of such a strategy is positive. If this is the case and capital markets are perfect, that is, no asymmetric information and moral hazard is present, banks should be also prepared to finance this period of distress. Thus inheritance should have no impact. The fact that inheritance is needed to overcome the distress situation is again pointing at imperfections in the capital markets caused by asymmetric information and moral hazard.

[11] For a more detailed description of the GSOEP see Lechner (1999) or Constant and Zimmermann (2006). Alternatively, visit http://www.diw-berlin.de/english/sop/ for a comprehensive data information.

[12] Note that one of our robustness checks is conducted on a sample that includes multiple spells.

[13] The models are estimated using Stata 9.2 software package. The do-files with codes are available upon request.

[14] Results are available upon request. The assumptions about a particular parametric distributions are hard to justify. Hence, we also check the robustness of results using Gaussian distribution for the unobserved heterogeneity term. The results follow the pattern of the reported estimates. Furthermore, we cannot reject the hypothesis of zero unobserved heterogeneity.

[15] See http://www.creditreform.de/Deutsch/Creditreform/Aktuelles/Creditreform_Analysen/Insolvenzen_Neugruendungen_Loeschungen/index.jsp.

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Appendix

Proof of Proposition 1. For $A = 0$ both project qualities yield equal profit if

$$p_h X - I = p_l Y - \frac{p_l}{p_h} I. \tag{4}$$

This equality is only satisfied with $I = 0$ for the benchmark type $\hat{\theta}$. If quality h should be realized and $\langle R_h I \rangle$ should be offered the benchmark type $\hat{\theta}$ faces perfect financial constraints. Now, consider projects for which Assumption 1 is satisfied. Given that $\theta_i > \hat{\theta}$ and $I = 0$ the left hand side of (4) increases. Note, that an increase in I decreases the left hand side more than the right hand side. Thus, for $\theta_i > \hat{\theta}$ equality in (4) can be restort with some $I = \hat{I} > 0$. Since $\partial E_h(\theta_i, \cdot)/\partial \theta_i > 0$ the crucial amount of I that satisfies (4) increases if θ_i increases: $\partial \hat{I}/\partial \theta_i > 0$. The monotonicity of the relationship between $\hat{I}$ and θ_i implies that there exists a $\theta_i = \tilde{\theta}$ for which the loan granted in equilibrium approaches I^*, and financial constraints vanish. The second step of the proof takes the possibility into account that the bank could alternatively offer only contract $\langle R_l I_l^* \rangle$. Note that the optimal I in case of $\langle R_l I_l^* \rangle$, which is satisfying

$$\frac{\partial E_l}{\partial I} = \frac{\partial p_l(I, \bar{\theta})}{\partial I} Y - 1 = 0 \tag{5}$$

is smaller than the optimal I in case of $\langle R_h I^* \rangle$, which is satisfying

$$\frac{\partial E_h}{\partial I} = \frac{\partial p_h(I, \theta_i)}{\partial I} X - 1 = 0.$$

Thus financial constraint $C = I^* - I_l^*$ arises if banks, in order to avoid losses, offer only $\langle R_l I_l^* \rangle$. Recall that $E_h(\hat{I})$ increases monotonically if quality h becomes better. Moreover $E_l(I_l^*, \bar{\theta}) > E_h(\hat{I}, \hat{\theta})$ in the benchmark case. Both properties imply that there exists a crucial level $\theta_i = \breve{\theta}$ such that $E_l(I_l^*, \bar{\theta}) = E_h(\hat{I}, \theta_i)$. For a rather small difference between l and h, that is ability is in the range of $\theta_i \in (\hat{\theta}, \breve{\theta})$, the active financial constraint is $C = I^* - I_l^*$ since the bank only offers $\langle R_l I_l^* \rangle$. For all $\theta_i \in (\breve{\theta}, \tilde{\theta})$ the active financial constraint is $C = I^* - \hat{I}$. q.e.d.

Proof of Proposition 2. The profit for all $\theta_i > \hat{\theta}$ is given by

$$E_h = p_h X - I - (1-p_h)(1-\beta)A$$

and

$$E_l = p_l Y - \frac{p_l}{p_h} I - (1-p_l)\Big(1 - \frac{1-p_h}{1-p_l}\frac{p_l}{p_h}\beta\Big)A$$

for quality h and l respectively. Consider a given type θ with $\theta_i \in (\hat{\theta}, \tilde{\theta})$. For symplicity we assume $\beta = 1$. Recall that without private assets the firm is constraint by (4). If pledgable assets are available the profit function for quality l is lowered but the profit function for quality h remains unchanged. This feature in combination with (4) immediately implies

$$p_h X - I - (1-p_h)(1-\beta)A = p_l Y - \frac{p_l}{p_h} I - (1-p_l)\Big(1 - \frac{1-p_h}{1-p_l}\frac{p_l}{p_h}\beta\Big)A$$

only for $I = \hat{I}(A > 0) > \hat{I}(A = 0)$. The lowering of E_l induces $E_h(\hat{I}(A > 0), A) > E_h(\hat{I}, A = 0)$ for all $\hat{I}(A > 0) \in (\hat{I}(A = 0), I^*)$. With $\beta < 1$ both profit functions are lowered if debt is secured. However, because of $(1-p_h)p_l/(1-p_l)p_h < 1$ the decrease for profit E_l is always larger than the decrease for E_h. This feature in combination with the fact that $E_h(\hat{I}(A > 0), A)$ increases with $\hat{I}(A > 0)$ for $\beta = 1$ guarantees that $E_h(\hat{I}(A > 0), A)$ also increases for $\beta = 1-\delta$, where δ is not too large. Thus the pledging of assets is compatible with C2. It increases profits as it allows a greater I. However, for types $\theta_i \in (\hat{\theta}, \breve{\theta})$ the increase in profits has to be large enough to excell $E_l(R_l\, I_l^*)$ if assets should ease financial constraints. q.e.d.

Proof of Proposition 3. Consider $S = 0$. In this case $E_h^S(I^*, S = 0) > E_h = E_l$ since investment incentives are not distorted in case of the screening option, and the pledging of assets in the non screening case reduces the profit E_h as the entrepreneur has to bear the dead-weight cost $(1-\beta)A$. Differentiation of E_h^S yields

$$\frac{\partial E_h^S}{\partial I} = \frac{\partial p_h}{\partial I} X - 1 \quad \rightarrow \quad \frac{\partial p_h(I_S^*)}{\partial I} = \frac{1}{X} \tag{6}$$

$$\frac{\partial E_h^S}{\partial S} = -1 < 0. \tag{7}$$

The first derivative (6) indicates that the optimal investment level I^* is independent of S. The second derivative (7) shows that the maximal profit decreases monotonically with S. For a given type the amount of plegded assets A determines investment and profit in the non-screening scenario. Both properties and $E_h^S(I^*, S = 0) > E_h = E_l$ ensure that for each given amount of pledged assets there exists a level $\bar{S}$ such that C5 is satisfied for all $S < \bar{S}$. In this array of S the available amount of assets will not be pledged. Thus, assets have no influence on the firms' success probability. If $S > \bar{S}$, C5 is not satisfied. Assets secure the debt and Proposition 2 applies. q.e.d.

Table 1: Sample statistics

Variable	Definition	μ	σ^2	N
$inheritance_{i,t-1}$	Equals one if inheritance in previous period	0.02	0.02	5248
$amount_{i,t-1}$	Amount of inheritance in previous period, 1,000 EUR	2.11	53.07	3917
sex_{it}	Equals one if female	0.36	0.23	5353
age_{i1}	Age at the beginning of spell	36.91	69.25	5353
$educ_{2,it}$	Equals one if high school education only	0.60	0.24	5353
$educ_{3,it}$	Equals one if (school) graduation and apprenticeship	0.14	0.12	5353
$educ_{4,it}$	Equals one if university education	0.16	0.14	5353
$size_{2,i1}$	Equals one if less than five employees inclusive	0.28	0.20	4874
$size_{3,i1}$	Equals one if more than six employees inclusive	0.29	0.21	4874
$income_{i1}$	Log of labor earnings at the beginning of spell	9.45	1.26	4625
$unemployed_{i0}$	Equals one if unemployed before self-employment	0.15	0.13	5353
$married_{it}$	Equals one if married	0.70	0.21	5353
$manuf_{it}$	Equals one if activity in manufacturing sector	0.07	0.06	5353
$services_{it}$	Equals one if activity in services	0.52	0.25	5353

Note: σ^2 and μ represent variance and mean respectively.

Table 2: Cloglog estimates of survival function

	(1)	(2)	(3)	(4)
$inheritance_{i,t-1}$	-1.0174**	-0.9448**		
	(0.4485)	(0.4491)		
$amount_{i,t-1}$			-0.0970*	-0.0878*
			(0.0557)	(0.0534)
sex_{it}	0.0168	0.0016	0.0442	0.0153
	(0.0910)	(0.0906)	(0.1111)	(0.1102)
age_{i1}	-0.0867**	-0.1011**	-0.0896*	-0.1054**
	(0.0412)	(0.0415)	(0.0492)	(0.0494)
age^2_{i1}	0.0015***	0.0016***	0.0015**	0.0017***
	(0.0005)	(0.0005)	(0.0006)	(0.0006)
$educ_{2,it}$	-0.0545	-0.0784	-0.0748	-0.1235
	(0.1373)	(0.1382)	(0.1799)	(0.1794)
$educ_{3,it}$	0.1808	0.1692	0.1020	0.0713
	(0.1616)	(0.1623)	(0.2047)	(0.2041)
$educ_{4,it}$	0.1362	0.1366	0.0612	0.0450
	(0.1590)	(0.1591)	(0.2058)	(0.2051)
$size_{2,i1}$	0.0969	0.0801	0.1365	0.1091
	(0.0961)	(0.0957)	(0.1139)	(0.1133)
$size_{3,i1}$	-0.1126	-0.0702	-0.1745	-0.1198
	(0.0973)	(0.0963)	(0.1230)	(0.1219)
$income_{i1}$	0.0478	0.0363	0.0276	0.0081
	(0.0429)	(0.0427)	(0.0513)	(0.0511)
$unemployed_{i0}$	0.4053***	0.3896***	0.3945***	0.3694***
	(0.1046)	(0.1048)	(0.1307)	(0.1307)
$married_{it}$	-0.0836	-0.0968	-0.0909	-0.1139
	(0.0853)	(0.0847)	(0.1038)	(0.1033)
$manufacturing_{it}$	0.8998***	0.9313***	1.4513***	1.4905***
	(0.1661)	(0.1647)	(0.2148)	(0.2142)
$services_{it}$	1.1266***	1.1513***	1.7143***	1.7485***
	(0.1004)	(0.0998)	(0.1467)	(0.1462)
N	4,082	4,082	3,132	3,132
Nonparametric baseline	yes	no	yes	no
Log likelihood	-1703.5001	-1718.9532	-1151.1593	-1163.2939

Note: Robust standard errors are in brackets. Regressions include constant. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)
$inheritance_{i,t-1}$	-1.0183**	-1.0813**	-1.0158**	-1.0833**	-0.8678**	-0.9373**
	(0.5061)	(0.5092)	(0.4477)	(0.4441)	(0.4408)	(0.4353)
sex_{it}	0.0043	0.0163	-0.1007	-0.0920	-0.0130	-0.0004
	(0.0909)	(0.0909)	(0.0786)	(0.0795)	(0.0919)	(0.0925)
age_{i1}	-0.1481***	-0.1374***	-0.0871**	-0.0727**	-0.1052***	-0.0921**
	(0.0424)	(0.0420)	(0.0351)	(0.0358)	(0.0399)	(0.0405)
age^2_{i1}	0.0023***	0.0021***	0.0013***	0.0012***	0.0017***	0.0016***
	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0005)	(0.0005)
$educ_{2,it}$	-0.0893	-0.0706	-0.0120	0.0023	-0.0644	-0.0419
	(0.1432)	(0.1426)	(0.1196)	(0.1175)	(0.1361)	(0.1330)
$educ_{3,it}$	0.1806	0.1878	0.2162	0.2282	0.1927	0.2055
	(0.1662)	(0.1655)	(0.1424)	(0.1426)	(0.1611)	(0.1604)
$educ_{4,it}$	0.1518	0.1457	0.2821**	0.2805**	0.1541	0.1535
	(0.1618)	(0.1619)	(0.1368)	(0.1370)	(0.1548)	(0.1539)
$size_{2,i1}$	0.0864	0.1040	0.0526	0.0660	0.0662	0.0780
	(0.0982)	(0.0986)	(0.0812)	(0.0814)	(0.0916)	(0.0914)
$size_{3,i1}$	-0.0567	-0.0905	-0.2433***	-0.2751***	-0.0729	-0.1105
	(0.0979)	(0.0986)	(0.0843)	(0.0878)	(0.0981)	(0.1024)
$income_{i1}$	0.0223	0.0302	-0.0117	-0.0041	0.0323	0.0408
	(0.0456)	(0.0456)	(0.0364)	(0.0368)	(0.0422)	(0.0424)
$unemployed_{i0}$	0.4370***	0.4522***	0.2487***	0.2647***	0.3726***	0.3858***
	(0.1069)	(0.1067)	(0.0877)	(0.0872)	(0.1095)	(0.1091)
$married_{it}$	-0.0847	-0.0655	-0.0747	-0.0698	-0.1252	-0.1140
	(0.0857)	(0.0866)	(0.0766)	(0.0778)	(0.0851)	(0.0862)
$manufacturing_{it}$	0.9512***	0.9160***	1.0027***	0.9683***	0.9322***	0.9048***
	(0.1726)	(0.1740)	(0.1426)	(0.1460)	(0.1683)	(0.1707)
$services_{it}$	1.2285***	1.2032***	1.2159***	1.1963***	1.1184***	1.0996***
	(0.1052)	(0.1059)	(0.0868)	(0.0876)	(0.0974)	(0.0988)
N	3,841	3,841	5,856	5,856	3,919	3,919
Nonparametric baseline	no	yes	no	yes	no	yes
Log likelihood	-1618.82	-1606.19	-2226.75	-2210.42	-1674.13	-1661.16
Family business, or farmers	no	no	yes	yes	yes	yes
Multiple spells	no	no	yes	yes	no	no
Self-employed parents	yes	yes	yes	yes	no	no

Note: Robust standard errors are in brackets. Regressions include constant. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Multinominal Logit Estimates of Competing Risk Model

	(1)		(2)	
	Employment	Unemployment	Employment	Unemployment
$inheritance_{i,t-1}$	-1.0114**	0.3005		
	(0.4760)	(0.7472)		
$amount_{i,t-1}$			-0.0928*	-0.0076
			(0.0552)	(0.0216)
sex_{it}	-0.0038	-0.0997	-0.0002	-0.1762
	(0.1020)	(0.2836)	(0.1248)	(0.3112)
age_{i1}	-0.1056**	0.1335	-0.1073*	0.2344
	(0.0453)	(0.1353)	(0.0555)	(0.1539)
age_{i1}^2	0.0018***	-0.0013	0.0018**	-0.0024
	(0.0006)	(0.0017)	(0.0007)	(0.0019)
$educ_{2,it}$	-0.1093	-0.3347	-0.1603	-0.1824
	(0.1533)	(0.3794)	(0.2025)	(0.4587)
$educ_{3,it}$	0.1656	-0.3312	0.0645	-0.0171
	(0.1802)	(0.4774)	(0.2310)	(0.5399)
$educ_{4,it}$	0.1253	-0.3825	0.0178	-0.2073
	(0.1770)	(0.4879)	(0.2318)	(0.5644)
$size_{2,i1}$	0.0922	-0.2901	0.1243	-0.3830
	(0.1076)	(0.2924)	(0.1281)	(0.3173)
$size_{3,i1}$	-0.0944	-0.8582**	-0.1374	-0.7293*
	(0.1074)	(0.3428)	(0.1358)	(0.3755)
$income_{i1}$	0.0301	-0.2881***	-0.0113	-0.3634***
	(0.0458)	(0.1091)	(0.0572)	(0.1210)
$unemployed_{i0}$	0.4549***	0.5062*	0.4447***	0.5555*
	(0.1190)	(0.2886)	(0.1495)	(0.3102)
$married_{it}$	-0.1100	0.0311	-0.1163	0.2299
	(0.0965)	(0.2874)	(0.1164)	(0.3204)
$manufacturing_{it}$	1.0147***	0.4688	1.5894***	0.3514
	(0.1812)	(0.5158)	(0.2322)	(0.5774)
$services_{it}$	1.2598***	0.5391*	1.8860***	0.4965
	(0.1063)	(0.2885)	(0.1536)	(0.3158)
N	4082		3132	
Log-likelihood	-2029.9870		-1420.9569	

Note: Regressions include constant. Semiparametric baseline. Robust standard errors are reported in the brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

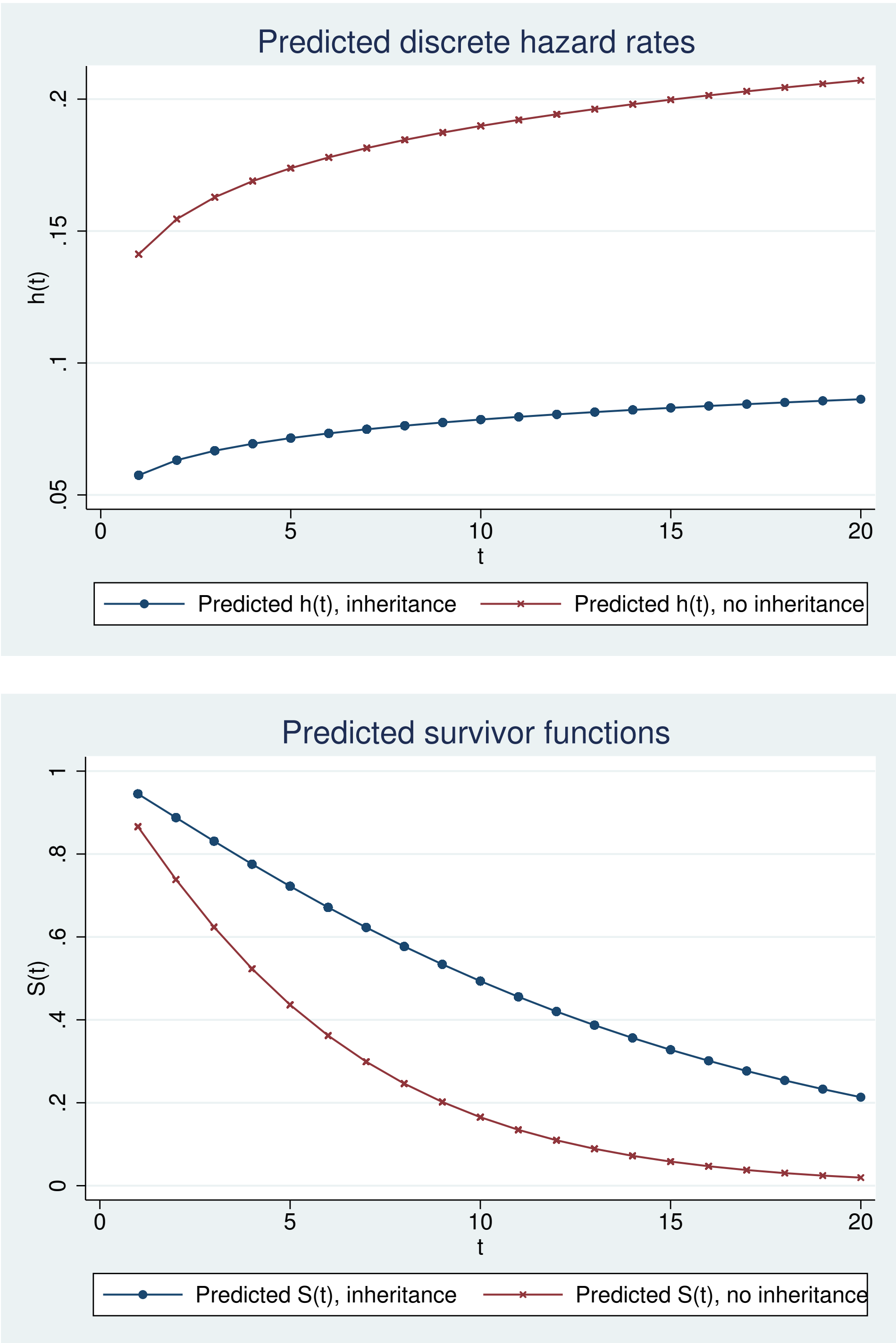

Figure 1: Discrete hazard and survival functions for a married male, aged 40, with pre-sample income of 5,000 EUR, and working in manufacturing sector.